NA MFO

3460 Technical Assistance March 11, 1982

Allegheny National Forest Gypsy Moth Infestation Potential

Forest Supervisor
Allegheny National Forest

The enclosed information on the gypsy moth is intended to acquaint you and your staff with the history, current status and hosts affected by this pest. It also provides information on forest stand relationships and the variables influencing tree defoliation and mortality. The information was put together by Larry Yarger of my staff following conversations with Porter Gearhart of the Allegheny.

While the Allegheny is not facing widespread problems in 1982, we feel that visible defoliation will begin to appear during 1983 and that some consideration should be given to making preparations for this. The first step of this process should be the development of a preliminary hazard rating of the Forest. Timber inventory data should be analyzed to identify oak-type stands, particularly those with a high percentage of white oak. These stands would then need to be further characterized in terms of species composition, site index, stocking level, age, slope and aspect.

Should you desire to proceed along these lines, Larry will be available to work with your staff. Please let me know your thoughts so that plans can be made accordingly.

Allan T Bullard

ALLAN T. BULLARD
Field Representative
Forest Pest Management

Enclosure

ATB/ham

Gypsy Moth Background Information for the Allegheny National Forest

Introduction

The gypsy moth Lymantria dispar (L.) is a defoliator of forest, shade, and ornamental trees in the northeastern United States. Despite efforts to reduce the risk of spread and to erradicate isolated pockets of infestation, the gypsy moth continues to persist and extend its range. Since the geographic range of gypsy moth is increasing, the potential for infestation becomes more significant to forest resource managers in areas not currently infested. As an initial effort to assess the potential for gypsy moth infestations on the Allegheny National Forest, this report discusses the status of the gypsy moth infestation in the Northeast and factors which influence a forest stand's potential for infestation.

History

In 1869, the gypsy moth was accidently introduced into the United States near Bedford, Massachusetts, during laboratory investigations of silk producing moths. Within a few years the gypsy moth became well established in surrounding forested areas and for the first 20 years after introduction, populations remained at low levels. In 1889, however, the gypsy moth caused considerable tree defoliation and mortality around Medford, Massachusetts. By 1905, neighboring States in New England had become infested, and in 1922, the gypsy moth reached New York. A barrier zone policy was established with the Hudson River being the line of treatment to confine the insect to New England. This policy continued until 1938 when high winds associated with a hurricane spread the infestation across the river. The current gypsy moth outbreak in the Northeast began in 1969 when defoliated acreage increased three-fold over the previous year. Acres defoliated have fluctuated from year to year since then, rising to 1.8 million acres in 1977, receding to 643,500 acres in 1979, increasing drastically to over 5.1 million acres in 1980, and further increasing to 12.9 million acres in 1981 (Figure 1).

The insect has continued to spread naturally southward and westward from the generally infested areas of the northeast through wind dispersal of moths or early instar larvae. In addition, increased travel of recreation vehicles, movement of trees and wood products, nursery stock, and outdoor household articles from infested to noninfested areas, have facilitated artificial spread of the pest. Outbreak populations presently occur in portions of Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont. Isolated infestations currently occur in localized areas of California, Illinois, Michigan, Nebraska, North Carolina, Ohio, Virginia, Washington, West Virginia, and Wisconsin.

In Pennsylvania, the gypsy moth is considered the most serious pest of forested areas. During 1932, infestations covering 400 square miles were detected in Luzerne and Lackawanna Counties of northeastern Pennsylvania. In 1934, three additional counties were found infested. These infestations were largely kept under control until 1969 through the use of various insecticides. In 1969, the gypsy moth was detected for the first time west

of the Susquehanna River and since then, defoliation has fluctuated each year until in 1981, a total of 2,527,700 acres of defoliation occurred (Figure 2). Spread of the insect during 1981 occurred at a rate of about four times that normally experienced. This was primarily due to high winds in May and as a result, infestations currently extend into 46 of the State. The eastern counties are hardest hit with the western and northern tier counties continuing to support very light populations. We anticipated that gypsy moth-caused tree defoliation and mortality will continue to move southward and westward from areas defoliated in 1981.

Initial infestation of areas is primarily dependent on the relative proximity of gypsy moth populations and dispersal of these populations both naturally and artifically. As shown in Figure 2, detectable levels of gypsy moth-caused tree defoliation occurred in the southeast section of Elk County, Pennsylvania, during 1981. Gypsy moth egg mass detection surveys conducted by Forest Pest Management during September 1981 indicated that low level populations are already present on the Allegheny National Forest on the Ridgway Ranger District in the Ridgway-Hallton area and near the Kane Experimental Forest. Considering that egg mass densities are currently very low, detectable levels of defoliation will probably not occur before 1983.

Hosts

Gypsy moth larvae feed on a large number of host trees, shrubs and vines. Favored hosts include oak, alder, apple, birch, aspen, basswood, tamarack, willow and hawthorne. Intermediately favored hosts include maple, hickory, beech, black cherry, elm, sassafras, eastern white pine, pitch pine, Scotch pine, jack pine and eastern hemlock, and least preferred hosts include ash, yellow poplar, red spruce, American sycamore, and black locust. Late instar larvae will feed upon tree species that younger larvae normally would not feed on such as hemlock, southern white cedar, pines and spruces. Since oaks are a common component of many forests in the United States, the distribution of this tree species will be a major factor in the ultimate range of the gypsy moth.

Forest Stand Relationships

The effects of repeated gypsy moth-caused tree defoliation can be devastating to host trees. Coniferous trees die after a single complete defoliation. Deciduous trees can withstand 1 or 2 years of heavy defoliation (> 50 percent); however, the probability of mortality increases sharply after the third defoliation. Trees that have been 40-60 percent or more defoliated will refoliate in July after larval feeding has ceased. The new leaves of refoliated trees are generally smaller and photosynthetically less efficient than spring leaves and are produced at considerable cost to the host tree in terms of utilization of stored food resources. A second consecutive year of defoliation to the point of refoliation stresses the tree further and may subsequently predispose the tree to secondary mortality factors such as the two-lined chestnut borer, Agrilus bilineatus, and the root-attacking fungus, Armillariella mellea.

Defoliation records from New England suggest that some oak forests have a history of repeated defoliation, while other stands have been defoliated rarely. This suggests that some stands are more susceptible to defoliation than others. Records also show that outbreaks tend to last longer in the susceptible stands than in those rarely defoliated, and those susceptible stands seem to act as outbreak foci for the other areas.

New England forests have been characterized on the basis of species composition and history of disturbance. In susceptible stands, the dominant trees--usually aspen, gray birch, scarlet oak, white oak and black oak--are short and scrubby with crown cover often being less than 50 percent. Susceptible stands grow on adverse sites characterized by steep and exposed physiography, thin or excessively drained soils, or rocky ridges. They also seem characterized by the occurrence of natural or manmade disturbances having occurred. The association of site disturbance and susceptibility involves a number of possible relationships. Such factors as windstorms, ice and snow, fires, and heavy logging injure and disfigure trees creating resting places and oviposition sites for the gypsy moth. Disturbance by opening up a stand can dry out the forest floor and reduce the litter layer thereby adversely affecting the small mammals and other insect predators that normally occur there. In contrast, resistant stands in New England commonly grow on deep loamy soils and possess well developed litter layers. Resistant stands are well stocked with vigorously growing trees. Species highly favored by the gypsy moth occur in susceptible and also resistant stands and the absence of structural features suitable for gypsy moth refuge does not guarantee that a forest stand will not be defoliated often.

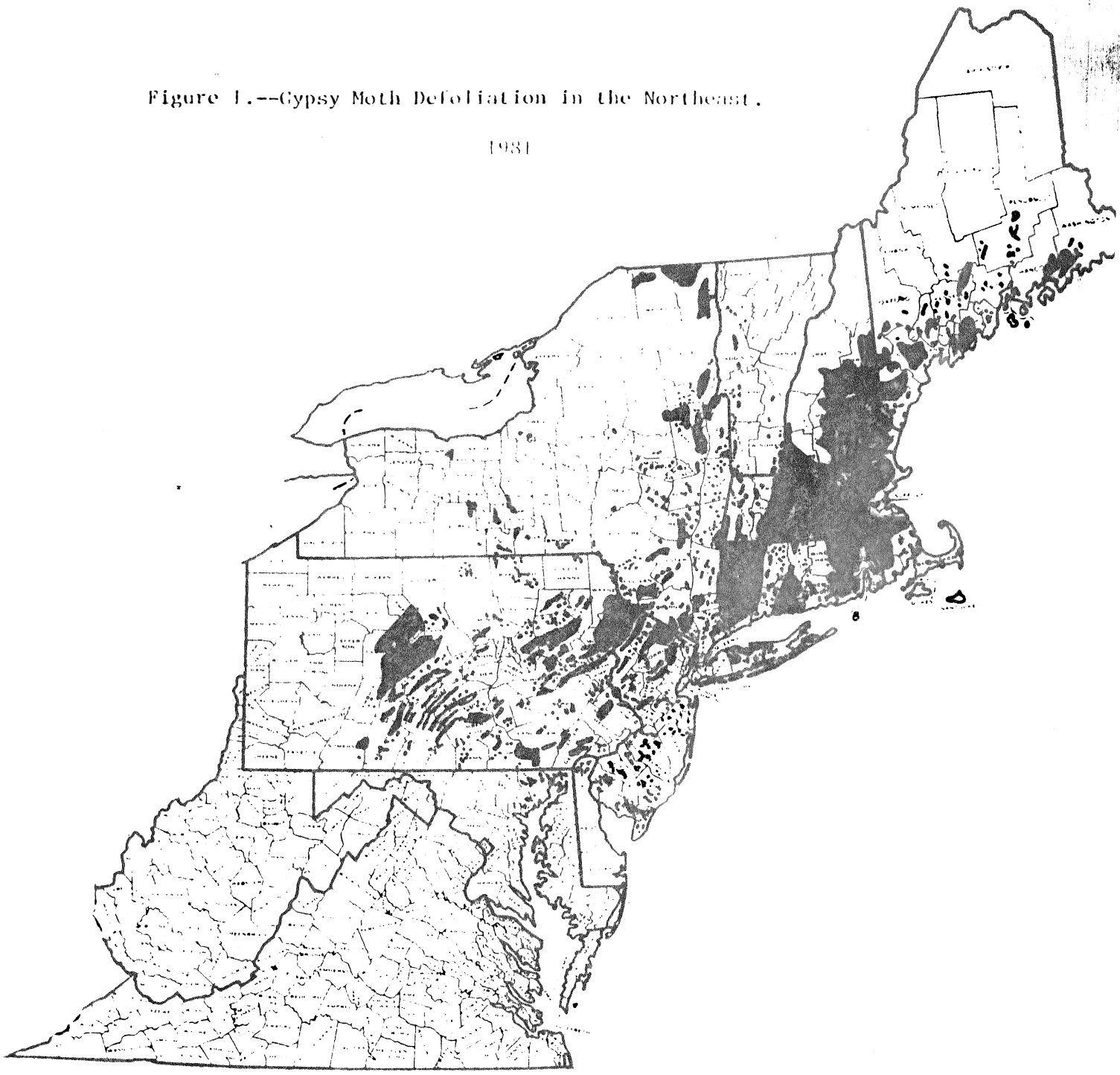
The incidence of tree mortality following defoliation can vary markedly both from stand to stand and within stands. Research indicates that there are several forest stand and site variables that influence the incidence of tree mortality. Some of the most important are the presence, abundance and condition of other defoliating insects and organisms of secondary action (Armillariella mellea and Agrilus bilineatus), the frequency and severity of defoliation, the occurrence of environmental stress such as drought and frost, other disturbances prior to and during defoliation, and the condition of the trees prior to defoliation. Forest stand characteristics that may correlate with vulnerability to mortality are: timber stand size composition, average tree diameter, stocking level, stand age, crown position, crown condition, site index, land capability, elevation, aspect, slope and position on slope. As mentioned, the magnitude of tree mortality is related to the number of years of successive heavy defoliation as well as refoliation. A single heavy defoliation resulting in refoliation may have little effect on tree mortality and stand structure. However, two or more years of heavy defoliation can cause significant mortality of host trees, subsequently affecting stand composition and structure. In general, mortality increases with the number of consecutive years of heavy defoliation.

Hazard Rating

Assessing a particular geographic area's susceptibility to gypsy moth-caused defoliation and vulnerability to mortality requires an in-depth evaluation of the many factors previously discussed. In 1978, Forest Pest Management in cooperation with the Northeastern Forest Experiment Station, initiated a 5-year pilot project to determine the predictive value of two mathematical models which have been developed to identify forested areas most likely to serve as reservoirs for gypsy moth outbreaks and areas most likely to experience heavy defoliation, mortality and high value loss following gypsy moth defoliation. The pilot project has been implemented along the Appalachian ridge system in southcentral Pennsylvania within an area where no gypsy moth defoliation has been previously recorded. Results of the pilot project will be addressed in a final evaluation report in 1983.

Figure 1.--Gypsy Moth Defoliation in the Northeast.

1981



(Prepared by USDA Forest Service based on late surveys.)

Figure 2.--Gypsy moth defoliation, State of Pennsylvania, 1982